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Original Communication

The epidemiology of repeat contacts with an Emergency Department or an Institute of Forensic Medicine due to violent victimization in a Danish urban population

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Abstract

Objective: The aim of this study was to describe the epidemiology of repeat contacts with an urban emergency department (ED) and/or an institute of forensic medicine.
Methods: All victims of violence in contact with the ED at Odense University Hospital and/or the Institute of Forensic Medicine, University of Southern Denmark 1991–2002 were included. Victims who had two or more contacts were identified as repeat victims and a recurrence proportion was estimated. Survival analysis was made with time of observation from the first to the second contact due to violence and a repetition percentage was estimated as the proportion with repeated characteristics in the incident leading to the second contact compared to the index contact and a repetition percentage was estimated.
Results: Overall 10,216 individuals with 14,307 incidents were included in the study. Overall, the recurrence proportion was 22% and repeat victims who were responsible for 44% of all contacts to the ED and/or the Institute of Forensic Medicine in the study period. The median time from first to the next incident was 1.75 years for males and 1.64 years for females. Overall 34% of the males and 37% of the females experienced the next incident within 1 year. The time span decreased significantly with increasing age for both males and females. The frequency of weapon use was low with a repetition percentage of 17% for males and 7% for females. For potential severe lesions such as bone fractures and internal lesions the repetition percentage was 28% and 19% for males and 23% and 25% for females.
Conclusions: The present study showed that contact with an ED due to violent victimization often is followed by subsequent contacts with the same ED and/or the IFM due re-victimization and that recurrent incidents share characteristics.

Keywords: Violence; Epidemiology; Injuries; Recurrence

1. Introduction

Repeat contacts with emergency departments (EDs) due to violent victimization are a phenomenon well known by those who work in hospital EDs. According to the US Centers for Disease Control repeat injuries account for 10% of all visits to EDs for injuries and 27.7% of these are caused by interpersonal violence.[4] Goins et al. indicated that repeated violence-related trauma constitutes 45% of all trauma admissions caused by violence.[8] Sims et al. showed that the 5-year recurrence proportion of violence registered in US level 1 trauma centres was 44% with a mean number

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of 2.6 incidents per victim.[17] Another American study showed a 32.6% recurrence proportion of penetrating trauma due to stab, gunshot or shotgun in a 5-year follow-up.[13] According to the 1992 British Crime Survey 32% of victims of assault in and around work and 39% of victims of pub fights were victimized more than once within 1 year.[11] Schwarz et al. found that those who died from intentional injury were more likely to have had a previous intentional injury, and the likelihood of future injury increased with the number of past traumas.[15]

From an epidemiological point of view the phenomenon of repeat violent victimization is difficult to deal with. First of all we need a long time span to identify the repeat victims. Secondly, we must take a run-in period into account to decide whether a given occurrence in the study period is the overall first or whether an earlier incident has occurred prior to the study period. Unfortunately, these criteria were not sufficiently met in any previously published studies based ED data. A precise description of the epidemiology of repeat contacts to an ED and/or an Institute of Forensic Medicine (IFM) including a description of the extent of repeat contacts and the assessment of the degree of similarity between recurrent contacts has implications for the planning of preventive strategies. Therefore, the aim of this study was to estimate the epidemiology of repeat contacts with an urban ED and/or IFM.

2. Materials and methods

Physical deliberate interpersonal violence was defined according to criteria of the World Health Organisation.[9] The population base for the study was the Odense Municipality in Denmark in the period 1991–2002. All victims of violence treated at the open access ED at Odense University Hospital or subjected to medicolegal autopsy at the Institute of Forensic Medicine (IFM), University of Southern Denmark were included as cases. In case of more than one contact for the same incident only the first contact was included. The Odense Municipality is a geographically well-defined urban area with a population of 185,000 inhabitants, mainly consisting of the City of Odense. The municipality has only one ED, the one at Odense University Hospital, and one IFM, the one at the University of Southern Denmark. The IFM covers both Odense Municipality as well as the entire southern part of Denmark. In Denmark all unexpected deaths are subject to a detailed medicolegal autopsy at the IFMs. Annually, about 200 medicolegal autopsies are carried out at the IFM at University of Southern Denmark and approximately 10 of these are victims of deliberate interpersonal violence.

The cases for the study were included prospectively and consecutively as they presented themselves at the ED for treatment. Data on these cases were extracted from the patient registration system. The system includes self-reported information coded with the NOMESCO classification.[14] Trained staff carries out all registration of 37,000 trauma patients that are treated at the ED annually. The cases from the IFM were identified by a complete review of all autopsy reports carried out by the first author. For all cases that were in compliance with the study case definition information on age, sex, and incident of violence was obtained from the patient registration system, medical records and/or autopsy reports.

In Denmark all registered inhabitants have a unique civil registry number (cpr-number), which follows each individual for his/her entire life. In the study we defined an individual as a person with a cpr-number. The cpr-number was used to identify individuals with recurrent contacts with the ED and/or the IFM. A 5-year run-in period from 1986 to 1990 was defined after analysis of the proportion of individuals victimized in the study period 1991–2002 who were also recorded as victims in the ED register 1980–1990. The first contact due to violence in each individual was defined as the index contact taking the run-in period into account. All individuals who were both victims in the study period 1991–2002 and in the run-in period 1986–1990 were excluded from the study. An individual who had two or more contacts due to violence in the study period were defined as a repeat victim.

3. Statistical methods

Non-parametric statistics with STATA 8™ was used for basic statistical analyses and a p-value < 0.05 was considered as statistically significant. Overall and gender specific recurrent proportions were estimated as the proportions of individuals with more than one contact with the ED and/or the IFM due of violence in the study period.

The victims' registered civil addresses in the study period were extracted from the Danish Central Office of Civil Registration. The age of the victims were allocated into different age groups which referred to the age at the time of index contact. Kaplan–Meier survival analysis was made with time of observation from index contact to the first date of: second contact due to violence, moving away from Odense Municipality, death, or December 31, 2002. Failure was defined as second contact due to violence. Prior to the study we estimated the proportion of victims from the study period identified in different length of run-in period. A longer run-in period revealed only a few misclassified non-repeat victims and index contacts.

A repetition percentage was estimated as the proportion with repeated characteristics in the incident leading to the second contact compared to the incident leading to the index contact. Fisher's exact test was used to determine statistical similarity between the incidents leading to the index and the second contact due to violence. The most severe lesion leading to the index contact was compared to the most severe lesion leading to the second contact. The study was approved by the National Data Protection Agency. As the study was a register-based study no approval from the Biomedical Research Ethics Committee was needed.

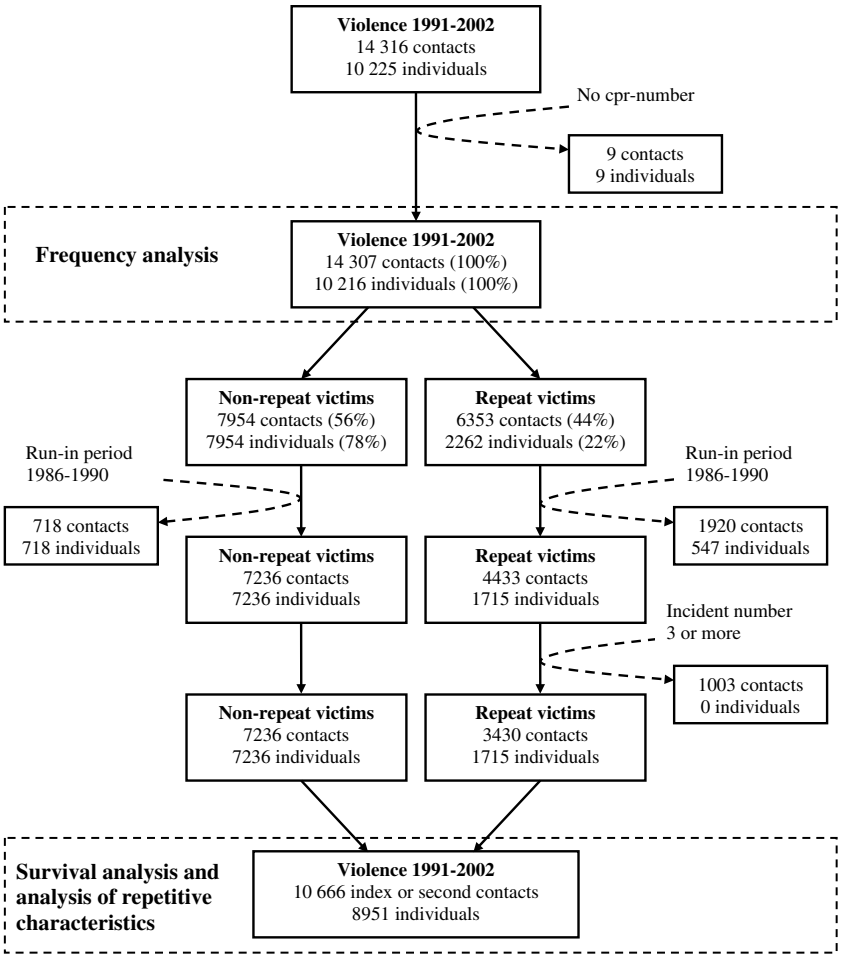

Fig. 1. The inclusion and exclusion of individuals and contacts.

4. Study population

Fig. 1 summarizes the inclusion and exclusion of individuals and contacts for the study. In the study period 14,316 contacts due to violent victimization involving 10,225 different individuals met the inclusion criteria. Nine individuals and their nine contacts were excluded as they did not have a cpr-number at the time of contact with the ED and/or the IFM. Those victims were immigrants who had not yet been assigned a cpr-number. This leaves 10,216 individuals and their 14,307 contacts for frequency analysis of repeat contacts. Then 1265 individuals and their 2638 incidents were excluded due to contacts in run-in period. Finally, all incidents number 3 or more were excluded leaving 8951 individuals with their 10,666 contacts for survival analysis and analysis of repetitive characteristics between index and second contact.

5. Results

In the 12-year study period 14,307 incidents involving 10,216 different individuals were included for frequency analysis. Among repeat victims 77% were males and 23% were females compared to 71% males and 29% females among non-repeat victims (Mann–Whitney, $p < 0.001$). For males the median age was 22 years (5–68 years) for repeat victims at the time of index contact and 24 years (range 0–94 years) for non-repeat victims (Mann–Whitney, $p < 0.001$). For females the median age was 29 years (range 4–94 years) for repeat victims at the time of index contact and 30 years (range 0–99 years) for non-repeat victims (Mann–Whitney, $p = 0.005$).

Overall 22% of the individuals were repeat victims who were responsible for 44% of all contacts to the ED and/or the IFM in the study period. For males and females 24% and 18% of the individuals were repeat victims who were responsible for 46% and 39% of all contacts. Table 1 shows the number of contacts with the ED and/or the IFM due to violent victimization stratified by gender. For those individuals with repeat contacts the median number of contacts due to violence in the study period was two for both males (range 2–15) and females (range 2–12). Thirty-four individuals died from violence in the study period. Of those who died, 27 (14 males and 13 females) died following the incident leading to the first contact and 7 died (4 males and 3 females) following the incident leading to the second contact in the study period.

Table 1
The distribution of individuals according to the number of contacts with the ED and/or the IFM due to violent victimization stratified by gender

	Males	Females	All
One contact	5619 (53.7%)	2335 (60.9%)	7954 (55.6)
Two contacts	2227 (21.3%)	645 (16.8%)	2872 (20.1)
Three contacts	1039 (9.9%)	323 (8.4%)	1362 (9.5)
Four contacts	525 (5.0%)	159 (4.2%)	684 (4.8)
Five contacts	234 (2.2%)	141 (3.7%)	375 (2.6%)
Six contacts or more	830 (7.9)	230 (6.0)	1060 (7.4)
All	10,474 (100.0%)	3833 (100.0%)	14,307 (100.0%)

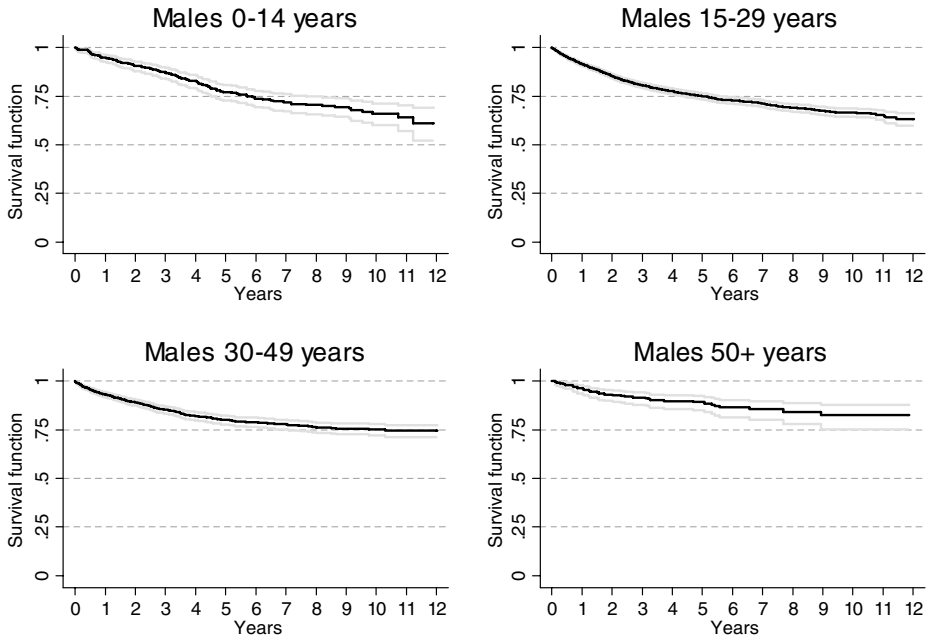

Fig. 2. Survival curves of the time span from index contact to the next contact due to violence for males stratified into different age groups including 95% CI (Kaplan–Meier).

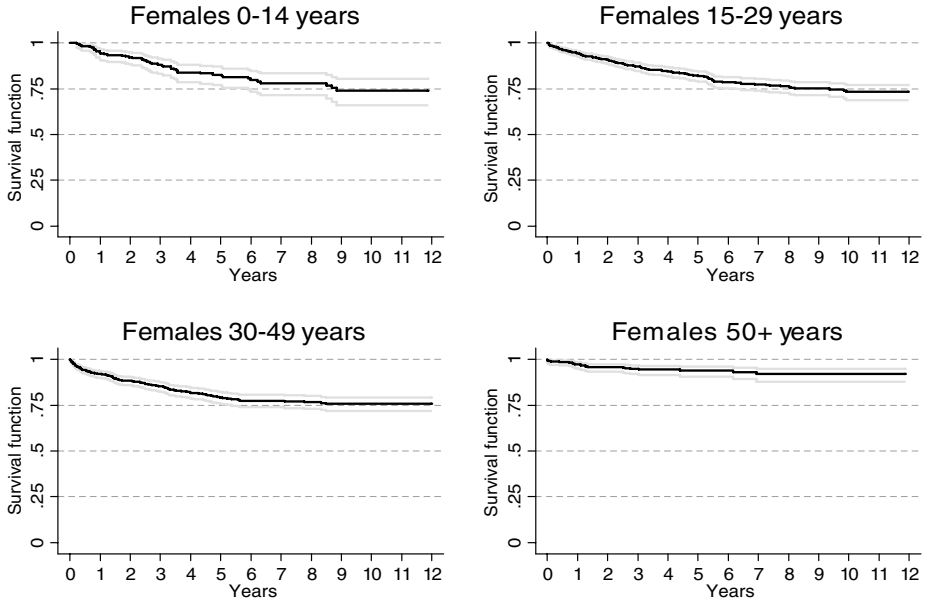

Fig. 3. Survival curves of the time span from index contact to the next contact due to violence for females stratified into different age groups including 95% CI (Kaplan–Meier).

Figs. 2 and 3 shows the survival curves of the time span from index contact to the next contact due to violence for males and females stratified into different age groups. The median time span from index to the second contact was 1.75 years (range 0–11.44 years) for males and 1.64 years (range 1.00–9.91) for females (Mann–Whitney, $p = 0.385$). Overall 52 (4%) males and 26 (7%) females experienced the second contact within 4 weeks, and 452 (34%) males and 146 (37%) females within 1 year. Within 4 years 79% of both males and females had experienced the next contact. For both males and females the median time span from index to the second contact decreased significantly with increasing age group. In the age groups 0–14, 15–29, 30–49, and 50-years the median time span was 2.85, 1.69, 1.62, and 1.53 years, respectively for males (Kruskal–Wallis, $p < 0.001$), and 2.46, 2.03, 1.34, and 1.11 years, respectively for females (Kruskal–Wallis, $p = 0.005$).

Table 2 summarizes the characteristics of the incidents of violence and the injuries leading to the index contacts and the repetition percentages in the incidents leading to the second contacts stratified by gender. For males and females index violence most frequently occurred in respectively public outdoor area and domestic area with a high repetition percentage (47% vs. 76%) (Fisher's exact, $p < 0.001$ and $p < 0.001$). A high repetition percentage was seen among males for violence occurring in the weekends and in the night time, respectively 72% and 59 % (Fisher's exact, $p < 0.001$ and $p < 0.001$), and among females for violence occurring in the weekends and in the evenings, respectively 56% and 50% (Fisher's, $p = 0.101$ and $p = 0.017$). For both males and females a minor part of index violence occurred with use of weapons. The repetition percentage for weapon use was 17% for males (Fisher's exact, $p = 0.006$) and 7% for females (Fisher's exact, $p = 0.323$).

In the majority of the index violence incidents the most severe lesion was a less serious lesions (abrasions or contusions), whereas internal lesions (internal organs, tendons, nerves or blood vessels) were relatively uncommon. Potentially severe lesions such as bone fractures and internal lesions occurred with a repetition percentage of 28% and 19% for males (Fisher's exact, $p = 0.006$ and $p = 0.189$), and 23% and 25% for females (Fisher's exact, $p = 0.041$

Table 2
The characteristics of the incidents of violence and injuries leading to the index contacts and the repetition percentage in the incidents leading to the second contacts stratified by gender

	Males			Females		
	Index (*n*)	Repetition percentage (95% CI)	Fisher's exact test	Index (*n*)	Repetition percentage (95% CI)	Fisher's exact test
Place of violence						
Public outdoor area	545	47 (41–53)	$P < 0.001$	75	39 (26–56)	$P < 0.001$
Domestic area	298	39 (33–45)	$P < 0.001$	248	76 (70–81)	$P < 0.001$
Recreational area	257	39 (31–47)	$P < 0.001$	23	13 (3–38)	$P = 0.128$
Other	219	23 (17–30)	$P < 0.001$	50	40 (24–67)	$P < 0.001$
Weekday						
Monday–Thursday	469	39 (33–45)	$P < 0.001$	189	51 (42–63)	$P = 0.072$
Friday–Sunday	840	72 (67–78)	$P < 0.001$	205	56 (46–67)	$P = 0.101$
Time of violence						
08.00–15.59	186	19 (14–27)	$P < 0.001$	72	26 (16–41)	$P = 0.037$
16.00–23.59	445	42 (36–49)	$P < 0.001$	189	50 (41–62)	$P = 0.017$
24.00–07.59	536	59 (53–66)	$P < 0.001$	88	32 (21–46)	$P = 0.004$
Weapon use						
Firearm, knife or club	87	17 (7–28)	$P = 0.006$	15	7 (2–37)	$P = 0.323$
No weapon	1232	92 (87–97)	$P = 0.006$	381	98 (88–108)	$P = 0.323$
Most severe lesion						
Less severe lesion	494	42 (36–48)	$P < 0.001$	228	61 (51–71)	$P = 0.003$
Wound	406	41 (35–48)	$P < 0.001$	56	25 (14–42)	$P = 0.014$
Sprain/dislocation	75	40 (27–57)	$P = 0.622$	32	28 (13–53)	$P = 0.233$
Bone fracture	251	28 (22–35)	$P = 0.006$	40	23 (10–43)	$P = 0.041$
Internal lesion[a]	27	19 (6–43)	$P = 0.189$	8	25 (3–90)	$P = 0.702$
Other	66	6 (2–16)	$P = 0.556$	32	9 (2–27)	$P = 0.575$
Referral						
No referral	623	52 (46–58)	$P < 0.001$	255	65 (55–75)	$P = 0.265$
General practitioner	363	32 (26–38)	$P = 0.001$	57	19 (10–35)	$P = 0.158$
Outpatient clinic	257	24 (19–31)	$P = 0.022$	68	19 (10–33)	$P = 0.121$
Hospitalised	76	15 (7–26)	$P = 0.033$	16	19 (4–55)	$P = 0.121$

[a] Internal organs, nerves, blood vessels or tendons.

and $p = 0.702$). Most male and female victims were treated in the ED with no further referral following the index violence. Of those hospitalised following the index violence 15% of the males and 19% of the females were also hospitalised following the next incident of violence (Fisher's exact, $p = 0.033$ and $p = 0.121$).

6. Discussion

The present study shows that contact with an ED due to violent victimization often is followed by subsequent contacts to the ED and/or the IFM due re-victimization. The overall recurrence proportion was 22% and repeat victims were responsible for 44% of all contacts to the ED and/or the IFM in the 12-year study period. Secondly, the study shows that about 1/3 of the repeat victims experienced the second contacts to the ED and/or the IFM within 1 year. Finally, the study indicates that there are some similarities between the incidents of violence leading to the index and the second contact.

For the sampling of a valid study population data we first employed the unique Danish civil registration system to separate individuals with only one contact due to violence from individuals with recurrent contacts. Secondly, the observation period was long and a run-in period was taken into account to verify whether an earlier incident leading to ED contact had occurred prior to the study period. Thirdly, we had access to precise and reliable information about the home address for each individual in the entire study period which made survival analyses possible.

Victims of violence seeking medical attention at the general practitioners, at neighbouring hospitals, or not at all were not included in the study. Therefore, results only refer to the phenomenon of repeat victimization from an ED and IFM perspective. A previous study from Odense Municipality has shown that about 11% of all injuries, mostly of a minor nature, are treated by the general practitioners.[10] An analysis of data from the same study region (approx. radius of 45 km) has shown that only 2% of all victims of violence from Odense Municipality seek medical attention at the neighbouring hospitals 45 km away.[7] Unfortunately, we have limited information about violence,which has not been registered in the health care or forensic medical systems. Preliminary results indicate that 13% of all registered victims of violence in the Odense Municipality are solely registered by the police and have had no contact with the health care or forensic medical systems (Faergemann unpublished). In another Danish study 15% of all registered victims of violence were solely registered in the police records without seeking medical attention in any hospital.[2]

When identifying the repeat victims and non-repeat victims for analysis of recurrent contacts and defining the index contacts a run-in period from 1986 to 1990 was taken into account. Selection bias may arise as victims identified as non-repeat victims may have had an earlier contact with the ED prior to the run-in period, and contacts defined as index contact, may not be the first contact. The estimation of the optimal length of run-in period prior to the study revealed only a few misclassified non-repeat victims and index contact if the run-in period was expanded.

Other studies have shown different recurrence proportions, but have not compared repetitive characteristics. Studies based on case series from US level 1 trauma centres have shown higher recurrence proportions than in our study.[8,13,17,19] Sims et al. showed a 5-year assaultive recurrence proportion of 44% in an urban population with a mean number of 2.6 assaultive incidents per repeat victim.[17] Morrissey et al. revealed a recurrence proportion of 32.6% for penetrating trauma due to stab, gunshot or shotgun alone in a 5-year follow-up with a mean number of two assaultive incidents per repeat victim.[13] Similarly, Goins et al. showed that 33% of patients with intentional penetrating abdominal trauma had previous admissions to the hospital for assault related injuries.[8] Tellez et al. showed that 16% of hospital trauma admissions due to gunshot, stab wounds or assault had previous intentional injury requiring hospitalisation.[19] The higher recurrence proportions in these studies may be due to the selection of victims in a level 1 trauma centre. Our study was based on data from an ED that treats all kinds of trauma patients from mild injuries to severe level 1 trauma patients.

Only one population based study has been conducted.[15] Schwarz et al. showed in a US African–American population an assaultive injury recurrence proportion of 14% in a 4-year period from different EDs.[15] This level is comparable to the current level at observation length of 4 years.

Survival analyses revealed that about 1/3 of the second incidents of violence occurred within the first year after the index injury. Before 4 years more than 3/4 of both males and females had experienced the second incident of violence. An American study showed that in trauma centre admissions due to violence with previous incidents of violence, 94% had suffered their previous injury within 5 years with a median length of time of 14 months.[19] Although, these results are similar to our results, the two studies are not comparable according to study population. In a study from New Zealand the probability of returning for an assaultive injury hospitalisation within 1 year for males and females previously assaulted was 6.3% and 6.7%.[5] Additionally, the study revealed, that of those hospitalized, 70% of the victims of violence were subsequently hospitalized within 30 days of the initial hospitalisation.[5]

The age and gender distribution, and the characteristics of the index violence in our study according to place, weekday, time, lesions and referral were similar to those in other studies of interpersonal violence.[1,5,6,12,16,18] The repetition percentage varied from 6% to 76%. For more severe lesions (bone fractures and internal lesions) the repetition percentage was 28% and 19% for males and 23% and 25% for females. Additionally, of those injured due to use of weapon in the index injury 17% of the males and 7% of

the females were also injured due to weapon use in the next incident. Although, the repetition percentage is low compared to other characteristics, it is remarkable and worrying that potential severe lesions are repeated for about 1/4 of the victims.

The current study underlines re-victimization as an important issue in the evaluation and assessment of hospital contacts after violent incidents. In the planning of preventive efforts this knowledge should be specifically addressed and in attempts to measure effects of strategies the repetition patterns should be taken into consideration. Especially, the relative high level of repetitious potentially severe lesions should hold an important position. The difficult question is how to address the issue. The diverse time pattern where subsequent episodes occur over many months after the first one indicates that several mechanisms are in play. Future studies should attempt to assess whether certain subgroups can be identified, so that specific effective intervention at the personal or environmental level can be implemented.

7. Conclusions

The present study showed that contact with an ED due to violent victimization often is followed by subsequent contacts with the same ED and/or the IFM due re-victimization. The overall recurrence proportion was 22% and repeat victims were responsible for 44% of all contacts in the 12-year study period. Secondly, the study showed that about 1/3 of the repeat victims experienced the second to the ED and/or the IFM within 1 year with a median time span from 1 to 3 years depending on age group. Finally, the study indicates that there are some similarities between the recurrent incidents of violence leading to ED and/or the IFM contacts.

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